

# **Physical Habitat Use and Water Quality Criteria for Snake River White Sturgeon (E.3.1-6 Chapter 2)**

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## **I. Introduction**

The purpose of the report is to describe the physical Snake River habitats used by various life stages of white sturgeon based on the literature and observations made during 10 years of study between Bliss Dam and the confluence with the Salmon River. The report provides a detailed assessment of white sturgeon habitat conditions in the Snake River on a reach-by-reach basis. The Applicant has collected and analyzed a comprehensive data-set of sturgeon essential life history functions including spawning timing, spawning and rearing location, egg deposition, larval emergence, water flows, and temperatures.

## **II. Conclusions**

1. *“We located spawning white sturgeon at spawning sites from March through early June while water temperatures were between 7.0 and 18.8 °C. Spawning sturgeon were often found in pools and runs with nearby high, turbulent water velocities such as those associated with high-gradient runs, tailouts from rapids, or dam tailraces. Mean column velocities and depths measured over telemetry sturgeon at the spawning sites ranged from 0.0 to 2.72 m/s and from 2 to 21 m. HIS criteria indicate that temperatures between 9 and 19 °C, velocities greater than 0.7 m/s, and depths greater than 2 m were suitable for spawning.” (Page 27, Paragraph 3)*

*“The embryonic development of white sturgeon eggs collected in reaches between Bliss Dam and the mouth of the Salmon River indicated that sturgeon spawned in the Snake River when water temperatures were between 12.0 and 17.7 °C. The mean water temperature was 14 °C, a level that is considered optimal for the development of white sturgeon eggs. Overall, most spawning activity appears to occur between 12 and 16 °C. As with spawning adults, we commonly found incubating eggs in turbulent pools and runs with mean column velocities and depths ranging from 0.1 to 2.0 m/s and from 4 to 19 m. HSI criteria indicate that temperatures from 6 to 20 °C, velocities from 0.79 to 2.6 m/s, depths between 3 and 24 m, and substrates larger than sand were suitable for incubation.” (Page 27, Paragraph 4)*

*“Based on temperature regimes in the Snake River and temperatures encountered during most egg collections (12–16 °C), we believe that peak spawning activity occurs from mid-March to the end of May upstream of the HCC and from late April to mid-June downstream of the complex. Egg incubation primarily occurs from mid-March through*

*early June upstream of the HCC and from late April to the end of June downstream of the complex.” (Page 28, Paragraph 1)*

*“We obtained our limited number of larval white sturgeon samples from two widely different habitats that included both riverine and reservoir environments. Larvae in the riverine section were sampled at the substrate in a deep turbulent pool where eggs and spawning adults were found. The capture of one larva in Brownlee Reservoir (4 m below the surface) highlights the mobility of this life stage and its potential to drift long distances from spawning sites during the dispersal phase. Habitat conditions associated with the collection of larvae included depths of 4 to 14 m, velocities of 0.00 to 0.90 m/s, and temperatures of 17.0 to 18.6 °C. HSI criteria indicate that suitable conditions for larval rearing include temperatures of 5.0 to 27.4 °C, velocities of 0.6 to 2.6 m/s, and depths of 3.9 to 30.4 m. The larval life stage is estimated to occur in various reaches of the Snake River from late March through the end of July.” (Page 28, Paragraph 2)*

*“We sampled no young-of-year white sturgeon with gill nets, and our setlines only captured sturgeon greater than 50 cm TL. HSI criteria for young-of-year white sturgeon in the Snake River, based on habitat information from McConnell (1989) and Parsley and Beckman (1994), indicated that suitable habitat conditions for young-of-year sturgeon include water temperatures between 0.1 and 28.0 °C, water velocities between 0.0 and 1.90 m/s, and depths greater than 6.1 m. We estimated that age-0 sturgeon begin to be found in various reaches of the Snake River by mid-April through early June.” (Page 28, Paragraph 3)*

*“The habitat used by juvenile and adult white sturgeon indicated a tolerance for a wide range of conditions, including both riverine and reservoir environments. In riverine sections, we often found sturgeon along current breaks in or near the thalweg of runs and pools. Sturgeon captured in reservoirs tended to use the middle and upper transition areas, while their use of the lower pool was low. We captured juveniles and adults at temperatures between 8.0 and 24.2 °C, with most collections occurring between 12 and 23 °C. Catch rates declined as temperatures exceeded 23 °C. Overall, juvenile and adult sturgeon were most often captured at depths greater than 6 m and water velocities less than 1.50 m/s. Although we found a few sturgeon at sites with relatively high velocities (up to 2.91 m/s) and very shallow depths (less than 2 m), the low number of collections under these conditions indicates that these conditions are not used frequently.” (Page 28, Paragraph 4)*

*“At locations where we sampled juvenile and adult white sturgeon, DO readings ranged from 7.3 to 15.1 mg/l. To minimize the stress and possible mortality of fish, we did not sample sturgeon at locations when the near-substrate DO level was less than 70% saturation. Linear relationships applied to data developed by Klyashtorin (1974) for several species of Russian sturgeon showed that DO values less than 4.4 mg/l reduced growth, while readings less than 1.8 mg/l were generally lethal at water temperatures between 3 and 28 °C. Low DO conditions commonly occur in several Snake River reservoirs during summer and fall months, resulting in suboptimal, or in some cases*

*lethal, conditions for white sturgeon, particularly in Brownlee Reservoir.” (Page 28, Paragraph 5)*

Response: The BLM agrees with these findings.

### **III. Study Adequacy**

This report is adequate. The white sturgeon habitat conditions of the Snake River from Swan Falls to the Salmon River are adequately documented. The report is complete and meets the objectives and needs necessary to make recommendations for future white sturgeon management.

### **IV. BLM Conclusions and Recommendations**

#### Conclusions

The report presents the detailed findings of the white sturgeon Snake River research that has been conducted over a ten year period from Bliss Dam at river mile 560 down to the confluence with the Salmon River. The researchers utilized a wide range of personal contacts and literature searches throughout the white sturgeon research community to design a sampling strategy to detect physical parameters that may affect Snake River white sturgeon. The approach is both comprehensive and innovative. The researchers utilized state-of-the-art techniques to monitor flow, temperature, spawning, egg production, larval production, young-of-the-year appearance, and juvenile and adult habitat utilization. Thousands of hours were expended in sampling the populations. Some captured sturgeon were surgically examined for spawning readiness, marked with sonic tags and then tracked through critical portions of their life history, including spawning.

The findings in some portions of the report rely on well-documented studies by other researchers that were used to support the Applicant's assumptions that lacked direct observation or data. All assumptions appear valid based on the Applicant's field observations and the body of existing peer-reviewed evidence cited.

The study clearly shows that the white sturgeon population in the Hells Canyon Reach below Hells Canyon Dam is healthy. The abundance and age structure of the population has improved significantly over the last 30 years. During the same time-span, the study shows that the populations in the Hells Canyon Complex reservoirs have not recovered from the low levels documented in 1970. Low numbers of white sturgeon in the reservoirs is related to extremely poor water quality. A secondary reason for low populations is the lack of suitable spawning habitat needed for reproduction.

#### **Summary of report findings and conclusions**

- The peak period of spawning occurred between March and early June while water temperatures were between 7.0 and 18.8 °C with a mean spawning temperature of 14 °C.
- Spawning sturgeon were usually located in pools and runs with nearby high turbulent water velocities associated with high-gradient runs, tailouts from rapids, or dam tailraces.

- Peak spawning activity occurs earlier upstream from the HCC and later downstream (mid-March through May vs. April to mid-June).
- Egg incubation occurs between mid-March through early June upstream from HCC and from late April through June downstream from the complex.
- Larval collections occurred at depths of 4 to 14 meters with mean column velocities of 0.0 to 0.9 meters/second and temperatures of 17 to 18.6 °C.
- Rearing occurred from late March through the end of July.
- The young-of -the-year life stage occurred in the Snake River beginning in mid-April continuing through early June.
- Although adults and juveniles used a wide range of habitats from riverine to reservoir, they show reduced growth when dissolved oxygen levels drop below 4.4 milligrams/liter. Levels below 1.8 milligrams/liter are known to be lethal.
- During low flow years, low D.O. conditions lethal to sturgeon can comprise up to 80% of the bottom 2 meter water layer in Brownlee Reservoir. In 1990, when water temperature in Brownlee Reservoir reached 25-26 °C and the oxygen levels were depleted, a kill of 28 white sturgeon was recorded.
- Most adults were found at depths greater than 6 meters with water velocities less than 1.5 meter/second.

#### Recommendations

No additional recommendations are required.